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# Dundee Discussion Papers in Economics

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## Contracts in the National Health Service: An Empirical Study

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# **Contracts in the National Health Service: An Empirical Study\***

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## **Abstract**

Contracts for health services in the British National Health Service (NHS) take a number of different forms. This paper reviews and then tests the economic theory of contracts as applied to the provision of health services. We find that contracts used in the NHS can be reconciled with predictions from contract theory, that there is stronger evidence of incentives than of risk sharing influencing the form of contract used and that the presence of clinicians in contract negotiations affects the form of contract used in a way that is consistent with them reflecting the interests of patients. We consider the implications of these findings for policy towards publicly funded health services.

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# 1. Introduction

The reform of the British National Health Service (NHS) that started in 1990 resulted in health services that are purchased by means of a contract between a Health Authority<sup>1</sup> or a fundholding<sup>2</sup> General Practitioner (GP) practice and an NHS Trust Hospital<sup>3</sup> or private hospital. The form of these contracts is varied and continues to change as purchasers and providers learn more about the nature of the contracting process. There are, at present, at least four different forms of contract used in the NHS. One explanation for the variety of NHS contracts is to be found in the economic theory of contracting. Contract theory is concerned with examining what forms of contract will best achieve the aims of purchasers. It therefore suggests that the form of contract that is adopted will vary in a consistent way with such factors as the nature of the services being contracted for, the aims and objectives of purchasers and providers who are parties to the contract and the information that is available at the time a contract is written. The purpose of this paper is to empirically assess the predictions of contract theory in relation to the forms of contract that are used in the NHS. We use two sources of data and consider the relationship between contract form and observable characteristics of the services being purchased, the purchaser, the provider and other exogenous variables using a multinomial logit model. For both data sets we find significant relationships, which can be reconciled with contract theory. We also find that it is possible to discriminate between an incentive based explanation of the form of contract adopted and a risk sharing explanation. Although, given data limitations, the evidence needs to be interpreted cautiously we find more support for an incentive explanation than for a risk sharing one. We further find that the form of contract chosen depends on whether clinicians are involved in contract negotiations and that the effect of having clinicians present is consistent with them reflecting the interests of patients. This last finding, therefore, provides some justification for the Department of Health's policy of recommending the inclusion of clinicians in the contracting process. The most prevalent form of contract in the NHS allows the possibility of costs being taken into account in determining payment to hospitals which mirrors recent evidence from the US which indicates that even the, supposedly cost independent, prospective payment system has an element of cost dependency - see McClellan (1997). Whilst the potential gains from reimbursing costs have been discussed from a theoretical perspective, there has not

previously been evidence on whether cost reimbursement is used in practice when it is most appropriate. Our findings provide such evidence and are, therefore, relevant to the policy debate regarding the regulation of publicly funded health service purchasing.

In the context of health services, contract theory has been most extensively applied to discussing the merits of the US Medicare reforms that started in 1983 and which affected the form of contract that Medicare uses to purchase health services for the elderly. Prior to 1983 Medicare purchased health services by repaying the costs incurred by the suppliers of those services. The form of contract between purchaser and provider was therefore termed *cost reimbursement*. From 1983 Medicare, under a system that has become known as *prospective payment*, specified a fixed price for the treatment of patients who fall within a defined *Diagnosis Related Group* (DRG). The relative merits of cost reimbursement and prospective payment have been well researched. Attention has focused on the twin concerns of health care purchasers to keep costs down and to ensure that health services are of appropriate quality. Whereas cost reimbursement gives no incentive for providers of services to keep costs down, prospective payment gives little apparent incentive to maintain quality. However, if a provider faces a demand for its services that depends upon quality, prospective payment may give appropriate incentives. Allen and Gertler (1991) and Rogerson (1994), for example, consider how a price per treatment can be set so as to induce appropriate choice of quality in these circumstances. An alternative to relying on price is to allow *partial* reimbursement of costs so that Ellis and McGuire (1986), Ellis and McGuire (1990), Glazer and McGuire (1994) and Pope (1989) analyse contracts with a combination of a fixed price and partial cost reimbursement. Ma (1994) shows that, under appropriate conditions, prospective payment can achieve both efficient quality and efficient effort to reduce costs. Chalkley and Malcomson (1998b) consider how, when those conditions are not met, alternative *prospective* contracts can achieve efficiency, whilst Chalkley and Malcomson (1998a) consider how an element of cost sharing can re-emerge, when first best outcomes are not feasible, as a means of establishing the second best. A common theme in this theoretical literature is, therefore, a distinction between contracts that specify payment varying with either (or both) of volume of activity and the costs associated with that activity. We henceforth refer to such variation as *volume dependency* and *cost dependency* respectively.

Whilst there is an extensive theoretical literature on health contracts, there has not previously been the opportunity to test that theory directly. Following the introduction of prospective payment, a number of studies such as, DesHarnis *et al* (1987), Freiman *et al* (1989), DesHarnis *et al* (1990), Cohen and Spector (1996) and Ellis and McGuire (1996) have considered the implications of the switch to prospective payment for treatment quality and cost. This literature provides evidence that the incentive properties of prospective payment posited by theory exist in practice but cannot be used to assess whether purchasers deliberately use incentive contracts that are appropriate to the circumstances in which they purchase health services because in Medicare purchasers do not have a choice of the form of contract that they enter into. Recently, McClellan (1997) has considered the extent to which prospective payment is, in practice, retrospective (as a consequence of DRGs that are defined in terms of *treatment* rather than *diagnosis*) and finds evidence that there is cost reimbursement under prospective payment. The question as to whether the health services that are subject to cost reimbursement are the ones that theory suggests cost reimbursement is most relevant to is not, however, addressed.

## 2. Contracts in the NHS

The reformed NHS provides an interesting and novel testing ground for contract theory because of the discretion that purchasers and providers are allowed over the type of contract they adopt. In the NHS the most prevalent form of contract, at least initially, simply specified a lump sum payment. These are termed *block contracts*.<sup>4</sup> Some contracts, which have become known as *sophisticated block contracts* combine a lump sum payment with some arrangement for determining payment should the actual volume of services fall outside of the expected or *indicative* volume range. Sophisticated block contracts typically do not precisely specify what payment will be made in the event that the indicated volume of services is not met but they allow the possibility of *ex post* negotiation. A more precise (*ex ante*) linkage between payment and the quantity of services delivered is contained in a *cost and volume* contract. Typically, in this kind of arrangement a fixed payment is agreed to cover the delivery of services up to some limit, thereafter services are paid for at an agreed rate per case. Finally a small number of services are contracted for on the basis of *cost per case* contracts in which a fixed price is attached to a particular treatment.

These different forms of contract exhibit variations in cost and volume dependency.<sup>5</sup> Using this categorisation, block contracts contain no element of either cost or volume dependency and have no equivalent in health care systems in the US. Cost per case contracts are a simple (linear) form of volume dependency with no element of cost dependency. Cost and volume contracts are a more complex (non-linear) form of volume dependency with again no element of cost dependency. Sophisticated block contracts, because of their lack of precision in defining payment when volume thresholds are breached are more difficult to classify. The existence of volume as a trigger for re-negotiation indicates a kind of *ex post* volume dependency. For example, a typical sophisticated block contract contains the following statement regarding payment if volume is below the defined threshold:

“Where projected activity appears unlikely to meet the minimum volume specified in (paragraph) 6.2 the Authority will wish to re-negotiate the Contract Price on the basis of a marginal cost adjustment or agree with the Service Provider what action is to be taken to achieve it”

In the NHS contracts that are explicitly cost-dependent are not permitted. However, there is evidence that sophisticated block contracts allow *ex post* cost dependency again through the possibility of re-negotiation. For example, the following relates to the case of volume exceeding an upper threshold:

“The maximum volume specified in (paragraph) 6.2 must not be exceeded without the Authority’s prior agreement ....in which case consideration will be given to case mix in determining the contract price”

In this quotation, the reference to case mix indicates one mechanism for, *ex post*, incorporating costs into the contract payment. Some sophisticated block contracts also allow for re-negotiation *triggered* by cost considerations as, for example, in the following:

“Where projections indicate that the maximum number of completed consultant episodes as specified above cannot be achieved for the contract price, the Authority should be informed as soon as this situation becomes clear. The Authority would only consider a re-negotiation of the contract (price) if cost increases can be shown through documentary evidence to be beyond the Service Providers control and if they exceed 1% more than the agreed inflation allowance in paragraph 7.4 below”

Because the contracts observed in the NHS exhibit variation in terms of both cost and volume dependency, they provide an opportunity to assess the predictions of contract theory. In the next section of this paper we begin by reviewing in more detail the reasons suggested by contract theory for cost and volume dependency in contracts for health services. In that discussion we, for convenience, refer simply to *purchasers* and *providers* of health services without detailing the institutions prevalent in the NHS. We then, in Section 3, detail our empirical study of contracts in the NHS based on two data sets and relate the theoretical predictions discussed in Section 2 to the observed variables. Section 4 of the paper reports the results of the empirical investigation and the final section of the paper discusses those findings.

### **3. Theoretical issues**

The starting point for a consideration of health contracts is the perceived concern of a purchaser to obtain both the quality and quantity of health services that it wants at a cost that it is prepared to pay. Since decisions that affect all of these aspects of health services are taken by the provider of those services and cannot be easily monitored, the form of contract that is chosen will have an important effect upon incentives. This is what, following Holmstrom and Milgrom (1991), is called a multi-task principal agent problem. The analysis of this problem lies at the heart of much of the consideration that has been given to contracting for health services. See, for example, Ma (1994) and more recently Chalkley and Malcomson (1998b) and Chalkley and Malcomson (1998a). To draw some empirically testable propositions from that analysis we focus on the question of when it might be appropriate for a purchaser to incorporate either cost dependency, volume dependency (or both) into a contract. The literature suggests that (i) the characteristics of health services, (ii) the motivation of providers and (iii) information (available at the time a contract is written) about the precise diagnosis of patients (the *case mix*) and about costs of delivering health services need to be considered when discussing the desirability of cost and volume dependency.

It is useful, as a benchmark, to consider the conditions that are necessary for a block contract (one with neither cost nor volume dependency) to achieve a purchaser's objectives and then consider the implications of moving away from these conditions.



### 3.1 Block contracts

A block contract entails no cost or volume dependency and therefore, as with any contract that does not reimburse costs, provides incentives to engage in cost reducing effort. However, the payment that will be received by a provider will be independent of the many other decisions that it takes regarding the kind of services it provides. In particular, the quality of treatment that the provider chooses to offer will not affect its remuneration. It is usual to assume that a publicly funded purchaser has a concern for the interests of patients and, hence, for the quality of treatment that is offered. Therefore, a necessary condition for choosing a contract that does not provide any mechanism for rewarding the provider for serving patients interests would appear to be that the provider itself should be concerned for patients interests. This is the case of what can be called a *benevolent* provider. However, benevolence on its own is not enough to make a block contract acceptable to a purchaser because there are issues that the purchaser needs to address concerning variation in both the demand for and cost of services.

One problem that arises when the number of treatments that it is efficient to carry out is not known in advance is considered by Chalkley and Malcomson (1998a). The number of treatments required may be unknown either because of uncertainties about the demand for, or cost of, a particular treatment. If demand is too high or treatment is too costly, the amount given to the provider in a block contract may turn out to be too little and the provider may end up turning patients away towards the end of the budget period. This indeed was a feature of the NHS in the early stages of contracting. Such an outcome is unlikely to be efficient. If, on the other hand, the provider is given a large enough budget to treat all of the patients who might require treatment, the purchaser will have used up valuable funds<sup>6</sup> that it could have deployed elsewhere. In both cases, Chalkley and Malcomson (1998a) show that, provided there is symmetry of information *ex post*, a block contract can be improved upon by incorporating some volume dependence.

A related problem will arise even when the overall demand for treatments is predictable but when the case mix is uncertain provided there is, nevertheless, symmetry of information *ex post*. Again, conditioning payment on the volume of the particular types of patients that present themselves for treatment, i.e. adding volume dependency, will improve upon a block contract. In practice it is unlikely that case mix will be observed by

the purchaser, in which case we need to consider the implications of asymmetric information which are discussed below.

Hence, from a theoretical perspective, the precise requirements for a block contract to achieve what the purchaser wants are very stringent even when there is a benevolent provider. Generally a block contract can be improved upon when there is uncertainty over demand by incorporating some volume dependency. When providers are not benevolent or there is asymmetry on information there are reasons for incorporating *both* cost and volume dependency.

### **3.2 Provider objectives**

The antithesis of a provider that shares the concerns of the purchaser for patients is one that has regard only for its own welfare. Such a provider can be called *self-interested*. The question of how to ensure, through a contract, that a self-interested provider delivers the kind of health services that the purchaser wants has been extensively researched.

The essential tension in the case of contracting with a self-interested provider is between ensuring incentives to supply high quality and incentives to keep costs down. To keep costs down a contract that avoids reimbursing costs will give appropriate incentives. Therefore, self-interest on the part of a provider would appear to exert pressure away from cost dependency. However, the problem with any payment system that does not reimburse the costs of a self-interested provider is that it apparently gives little incentive for that provider to produce high quality services, unless there is some mechanism that links a hospital's revenues to the quality of treatment it offers. The literature on health contracting has considered that one possible mechanism for making this link is patient demand. Ma (1994) shows that, provided that patients can perceive the differences between providers in terms of the quality of treatment that they offer *and* can respond to those differences by choosing where to be treated, a volume dependent payment has the potential to ensure the provision of the quality of health services that a purchaser would like to see. Chalkley and Malcomson (1998b), considering a case where it might not be efficient to treat all those who demand treatment, show that a contract can be improved by conditioning payment on a measure of excess demand as well as volume of treatments. In any case,

at least in a symmetric information setting with patients who are aware and respond to quality, there are good reasons for not incorporating cost dependency.

If patients are either unable to assess the actual quality of health services that a provider delivers or unable to respond to any perceived quality differentials, it may be necessary to make contracts cost dependent if the purchaser is concerned to maintain quality. In the usual terminology, it is when quality of health services is an *experience* good rather than a *search* good that contracts need to be cost dependent according to this argument. This conclusion needs, however, to be treated cautiously. If a provider is purely self-interested, it will be very costly to ensure quality through cost reimbursement because costs will have to be reimbursed (at least) in full and there will then be an incentive to inflate costs. Cost dependency is a more plausible mechanism for ensuring quality when a provider at least partly shares the concerns of the purchaser for patients. In such circumstances it is possible to partially reimburse costs in order to induce the provider to supply higher quality - see Chalkley and Malcomson 1997.

Most of the literature on health contracts considers strictly short term relationships. In such circumstances the objectives of a provider are important because it is necessary to build incentives into a single period contract. Where a purchaser deals repeatedly with the same provider it may be possible to observe performance over time. In any case, contract renewal can be made conditional upon aspects of performance that cannot easily be written into a short term contract. If reputation is an effective mechanism for ensuring that appropriate actions are taken by a provider, it may replace either cost or volume dependency in the incentive roles discussed above.

### **3.3 Asymmetric information**

There are other reasons for supposing that some element of cost reimbursement might be a desirable feature of contracts for health services. The literature on procurement discussed in Laffont and Tirole (1993), for example, focuses on the problem of a purchaser not having precise information about what the costs of supply are going to be whilst facing a provider that is better able to assess those costs. In such circumstances an optimal payment schedule will involve *partial* reimbursement of costs. In the case of health services uncertainty about costs would appear to be an important aspect of the contracting problem because the *case mix* is not known in advance and a provider is much

better able than a purchaser to determine the precise case mix it experiences. The quotations from NHS contracts cited in the Introduction illustrate precisely this issue. It is, therefore, likely that when there is substantial variation in costs across the case mix, cost dependency becomes more important.

### **3.4 Allocating risks**

The discussion above has focused on the incentive properties of contracts and has thus followed closely the literature on health contracting. The conventional approach of contract theory as discussed by Hart and Holmström (1987), emphasises the importance of the form of contract on the allocation of risks between parties. As noted above, the demand for many health services is uncertain as is the precise case mix that might face a provider. In addition to its concern with guaranteeing the delivery of health services and being frugal with its budget, a publicly funded purchaser may also, in such circumstances, be concerned with ensuring an efficient allocation of risk between itself and any providers that it deals with. A block contract, for example, will result in a provider being exposed to considerable variation in its income net of costs. Whether such an arrangement is desirable depends on the relative degrees of risk aversion of the purchaser and the provider and the extent to which an individual contract affects total income. If, for example, a provider contracts with many purchasers and the demands for its services from these different purchasers are uncorrelated, it may not matter that its income from any one purchaser fails to reflect fluctuations in demand. But, if a provider contracts with only one purchaser it will wish to have some insurance against fluctuating income. Both cost and volume dependency in the contract can help in this respect. Hence, the more risk averse is a provider or the greater is the variation in the demand for its services or its costs, the greater will be the pressure to include either (or both) cost or volume dependency in a contract, whilst the less able to offer insurance is the purchaser the less likely is cost or volume dependency.

It is worth noting that these traditional risk allocation issues are difficult to resolve in the context of a publicly funded institution like the NHS. Health authority purchasers have more resources than providers but are also on strictly cash limited budgets and are not, therefore in a good position to act as insurers. NHS Trust providers are small in relation to health authority purchasers but have some (albeit limited) ability to run a deficit or surplus in any given year.<sup>7</sup>

The theory discussed above suggests a complex set of determinants of cost and volume dependency which we summarise in Table 1.

## **4. An empirical study of contracts in the NHS**

### **4.1 Data**

We had available two sources of data. The first is copies of 236 contracts, all of which are drawn from the first round of contracting following the reforms of the NHS initiated in 1990. This data derives from either computer scanned copies of contracts as retained by the National Association of Health Authorities and Trusts (NAHAT) or from hard copies of actual contracts that were obtained from NAHAT. The second source of data derives from a telephone survey of health authority purchasers and contains summary information on 582 contracts from the 1993-1994 round of contract negotiations. In neither case do these contracts represent the outcome of unbridled free choice on the part of health authorities or fundholding GP practices as to the kind of contractual arrangement that they wished to enter into but rather they are a consequence of purchasers exercising some discretion whilst operating within guidelines set by the National Health Service Executive (see Robinson and Le-Grand (1993)).

#### **4.1.1 Data set 1**

For each contract in the first data set we could identify the date of the agreement, the duration of the agreement and information on a number of relevant characteristics.

First, and most importantly for this study, the form of the contract can be categorised into one of four types: block, sophisticated block, cost and volume, and cost per case. Since contracts do not specify their form according to this categorisation, we categorised them by examining their exact terms. We observe only 8 cost per case and 17 cost and volume contracts. Henceforth, we treat cost per case and cost and volume contracts as a single type denoted *Other* because of the paucity of the data and because, as discussed above, they have essentially the same characteristic of volume dependency with no cost dependency.

Second, the *type of services* that were being contracted for can be categorised into 4 groups: *acute hospital services*, *non-acute hospital services*, *mental health services* and *community health services*. The type of service has relevance for a number of the factors

identified above as important in the choice of contract. There is, for example, much greater uncertainty about what volume of services it is desirable to have delivered in the case of many acute service for which the demand varies considerably from year to year compared with mental health services, which have historically varied only little from year to year. Concerning the nature of quality of health care it is less likely that patients have information about mental health services, which are delivered to only a small number of individuals than about some acute services which are widespread and where individuals are, therefore, likely to have had contact with those who have direct experience of the treatment given by a particular hospital.

Third, we observe the nature of the purchaser (which can be either a health authority or GP fundholder) and some characteristics of the provider, such as whether it was an NHS Trust and whether it was in the same district as the purchaser. The distinction between GP fundholders and health authorities is potentially important because GP fundholders might, because they have more detailed information on their own patients, be expected to be better able to judge the quality of services that are delivered than a health authority. GP fundholders also have only small fixed budgets to spend on their patients and are permitted to purchase only a limited range of services. We observe whether, in the case of a health authority it contracts with a provider that is in its area or not. Local providers can typically expect long term relationships with their purchaser and hence in contracting with local providers, purchasers can rely to a greater degree on reputation to ensure the provision of high quality services

For each health authority contract we also observe the name of the health authority. This makes it possible to control for different priorities that health authorities might have in purchasing health services.

In addition to information about specific contracts we also had access to the Department of Health's *Health Services Indicators* for the year 1991-1992. This data set contains many socio-economic measures for each health authority as well as providing information on the number of hospitals and GPs that each health authority has within its area.

#### **4.1.2 Data set 2**

In the second data set we also have information on the form of the contract but in this case as reported by the purchaser. Hence, in this data set there are 3 reported contract

types, block, sophisticated block and cost and volume. There are no instances of cost per case contracts and so for consistency with our terminology for Data Set 1 we refer to cost and volume as *other*. By the date of the telephone survey the term sophisticated block contract was in common usage and although we could not go back and check whether the same criteria were used in defining these contracts as we had used for the first data set, other information on these contracts is consistent with their categorisation. Most contracts were sophisticated block and all contracts in the second data set have a health authority purchaser.

The type of services contracted for are categorised in the second data set only as either acute (hospital), community or mental health services. Whilst there is no way of discriminating between different types of provider directly, the survey asked about the role played by clinicians in contract negotiations. This may provide indirect evidence of the priorities placed by a provider on representing patients' interests and so it is a potentially interesting variable from the perspective of contract theory.

Additionally, in the second data set, we have details on the kind of information available in the contracting process, specifically, it was reported in the survey whether there was consideration of individual treatment costs or simply overall costs in formulating a contract price.

## 4.2 The empirical model

We consider the choice of contract type as being a consequence of observable characteristics of the services being contracted for, observable characteristics of the purchaser and the provider and other socio-economic factors with naturally some random influences that cannot be observed playing a role. We suppose a contract is chosen to best meet the objectives of the purchaser and assume that the various factors discussed in Section 2 will influence the choice of contract. To capture this in as simple a way as possible we suppose that a health authority derives utility from contract  $i$  being of type  $j$  according to:

$$U_{ij} = b_j X_i + \varepsilon_{ij}$$

where  $X_i$  is a vector of observations on contract  $i$  and  $\varepsilon_{ij}$  is a disturbance drawn from an extreme value distribution. Letting  $y_{ij}$  be a binary variable that takes the value one if a contract  $i$  is of form  $j$  and zero otherwise, then :

$$\sum_{j=1}^3 y_{ij} = \sum_{j=1}^3 P_{ij} = 1$$

where  $P_{ij}$  denotes the probability that contract  $i$  is of type  $j = 1, 2, 3$  corresponding to, respectively, block, sophisticated block and other (cost and volume or cost per case). The likelihood function for the data, given that we observe  $N$  contracts is, therefore:

$$\lambda = \prod_{i=1}^N P_{i1}^{y_{i1}} P_{i2}^{y_{i2}} P_{i3}^{y_{i3}}$$

The probability that contract  $i$  is of type  $j$  is:

$$P_{ij} = \Pr(U_{ij} > U_{ik}) \forall k \neq j$$

which, allowing for the distribution of the disturbances, becomes

$$P_{ij} = \frac{\exp(X_i' b_j)}{\sum_{j=1}^3 \exp(X_i' b_j)}$$

The parameters  $b_j$  measure the effect of  $X_i$  on the (log of) relative probability of observing a contract being one of two types. We normalise initially such that  $b_1 = 0$  and, hence, probabilities are expressed relative to that of a *block* contract. In order to compare sophisticated block and ‘other’ contracts we normalise such that  $b_2 = 0$ . The components of  $X_i$  and their summary statistics are reported in Table 2 whilst the distribution of contracts observed is depicted in Figure 1.

### 4.3 Relating observations to theory

We consider, as a starting point, the pattern of the growth of services in the NHS over the last 34 years. Table 3 summarises aggregate growth in hospital acute, non-acute and mental health services (no comparable data are available for Community services).

*Acute* services include most of the medical and surgical procedures carried out in hospitals, including those delivered by accident and emergency departments. Many of the contracts we considered covered a range of acute services. The precise mix of treatments that might be delivered under an acute contract could, therefore, vary considerably. This is analogous to variation in case-mix and, assuming that a hospital is better able to assess



the precise mix of patients that it receives, is a reason to expect cost dependency. The demand for acute services is also according to aggregate data more variable than for other categories of service. In part some of the variation in demand is absorbed through waiting lists, which in the NHS perform the role of a buffer stock. But for at least some acute services, for example accident and emergency procedures, variations in demand must be met with treatments. Theory suggests that this will contribute to volume dependency firstly because contracts need to ensure that hospitals have appropriate incentives to treat needy patients and second to offer some protection to hospitals from variation in their incomes.

*Non-acute* services are concerned with the treatment of chronic illness or disability and are largely accounted for by geriatric services in the NHS. In the UK as in the US (see Norton (forthcoming) and Norton and Newhouse (1994)) there is perceived to be chronic excess demand and limited capacity. From an incentive viewpoint, excess demand relative to capacity means that there is greater certainty regarding the volume of services that the purchaser can have delivered because this is determined by capacity and that there may be less need for volume dependency, if providers can be relied upon to be concerned about their patients. If, as seems likely, the recipients of non-acute services have relatively little choice and providers cannot be relied upon to deliver high quality, then cost dependency will be important.

*Mental health* services have a number of distinctive characteristics as a category of health care provision (see DesHarnais, S. I., Wroblewski, R. and Schumacher, D. (1990)) and particularly in the context of the NHS. First, there is relatively little variation in the total demand for these services over time (indicated both by the low overall growth rate and as measured from historical data on *finished consultant episodes* (FCEs) per 1000 of population and by number of hospital admissions). Second mental health services constitute a small (less than 10% of total hospital expenditure in the NHS) but tightly defined set of services. Third the average cost of a FCE where mental illness is the originating cause is very high because the average duration of hospital stay is long (56 days for mental illness and 200 days for forensic psychiatry in 1992/3 compared with 8.5 days for cardiothoracic surgery, for example) but the cost per day is relatively low (£123 for mental illness compared with £425 for cardiothoracic surgery in 1992/3, for example). Hence, the number of FCEs is relatively small. Finally, partly due to the relatively small scale of these services and partly because they are sometimes delivered to individuals who are

deemed incapable of rational decisions, there is relatively little patient choice as to where to be treated. The predictability of demand coupled with lack of patient choice reduces the need for volume dependency. Whilst the need to provide incentives for high quality works in the direction of increased cost dependency, the relative homogeneity of mental health services (a more certain case mix) may work against this suggesting an overall ambiguous prediction.

*Community services*, which include health visiting and some geriatric at-home services, are unlike many hospital acute services in that they are likely to be supplied up to the capacity of the health care system rather than constrained by demand. There is therefore likely to be less uncertainty regarding the quantity of such services that the health authority would like to see delivered. Community services are also characterised by problems of measuring activity. For hospital services the FCE is a standard measure of activity. No comparable measure exists for Community Services. This suggests that the cost of incorporating volume dependency is high and that such dependency is, therefore, unlikely. Nevertheless community services, like non-acute services, are such that patients are often perceived to have little choice about who provides them. This is because in the case of community services the location of the provider is of paramount importance. In such cases theory suggests that contracts will need to incorporate cost dependence.

Contracts for *multiple* services benefit a provider, enabling it to diversify the risk of uncertain demand which should, therefore, make cost and volume dependency less necessary from the perspective of sharing risk. However, where multiple services are being contracted for possible variation in case mix would seem to be of great importance. This should lead to greater cost dependency. Such contracts, therefore, provide an indirect way of testing competing theories of contract choice. If contracts for multiple services are generally less cost *and* volume dependent than other contracts the risk spreading aspects of contract choice would appear dominant. If, however, such contracts incorporate more cost dependence, there is *prima facie* evidence in favour of incentive effects being dominant.

The interpretation of the effect of a provider being an NHS *Trust* is not clear. At the time when the contracts for which this variable is observed were in operation, the alternative to Trust status was a hospital that was a Directly Managed Unit (DMU) and therefore still under the management of a Health Authority. One possibility that has been discussed is that the adoption of Trust status moves a provider away from the central ethos of the

NHS and, therefore, might be synonymous with a need for the purchaser to provide stronger incentives for it to act in patients' interests. If this view is accepted then there would need to be more cost and volume dependency in contracts with Trusts.

A health authority's information regarding the quality of services provided by hospitals *external* to its own area is likely to be less good than its information concerning hospitals that were previously directly managed by it. It is also less likely to be engaged repeatedly with the same external provider. These facts mean that mechanisms within a contract to ensure high quality are of greater importance. Both cost and volume dependency have a role to play in providing incentives to produce higher quality and so the prediction from theory is that such contracts should be more cost and volume dependent.

If GPs have better information than a health authority regarding the quality of service that a provider offers and they have freedom to use that information in directing patients, incentive arguments suggest that the contracts that they write should have less volume and cost dependency than contracts written by health authorities. In contrast with the argument concerning multiple services, the requirements of efficient risk sharing reinforce a tendency towards less cost and volume dependency in contracts. GP's have small budgets relative to most providers which should make them inclined to prefer contracts which entail certain payment.

The effects of *competition* variables are difficult to predict from the perspective of contract theory. The hypothesis that greater competition between providers reduces the need to structure quality incentives in contracts is one possibility. However, for the reasons considered by Spence (1975), the effect of competition on quality is not obvious. The industrial organisation literature - see Tirole (1989) - suggests that it is likely that competition affects the price at which a contract is carried out, but that does not necessarily have any implications for the *form* of contract that it makes sense to use. Competition between purchasers has similar ambiguous consequences for the choice of contract form.

The presence of *clinicians* at negotiations may indicate something about either the organisation or the objectives of a provider. If clinicians represent the interests of patients they may move a provider in the direction of what we have referred to as benevolence above. In which case, compared with a self interested provider (for which cost reimbursement is a very costly mechanism for ensuring quality) it can be expected that contracts will be more cost dependent. However, there is not any clear suggestion from theo-

retical considerations regarding the effect of such a concern for patients on volume dependency. If, for example, clinicians are so powerful as to lead a provider away from self interest and towards *benevolence*, as described above, it may be possible to reduce volume dependency and still ensure an adequate quality of service. But if there is only a partial movement towards benevolence, volume dependency may remain a valuable incentive for delivering quality.

In the second data set the *information* variable potentially captures how much cost information is available to use in a contract. The interpretation of this is, however, also difficult. On the one hand better information on costs enables contracts to be written in terms of prices per treatment and so facilitates volume dependency. On the other hand the better is information on costs *ex ante* the less need there would appear to be to write contracts which are *ex post* cost dependent. Unfortunately, from the structure of the telephone survey it is not clear that respondents would necessarily report the information that is available *ex ante* rather than *ex post*.

The predictions from theory regarding the effect of the observable variables on cost and volume dependency are summarised in Table 4.

## 5. Results

The model described above was estimated separately on both data sets using the maximum likelihood criterion via the LIMDEP package. For the first data set, we initially included all of the components of  $X_i$  and then dropped the health authority dummy variables that were insignificant. This procedure resulted in all of the health authority dummies except *D15* (Eastbourne DHA), *D19* (North Tyneside DHA) and *D34* (Cambridge DHA) being dropped. For the second data set, we report the results obtained from including all of the available components of  $X_i$  which reduces the size of our sample (because of missing observations on *CLINSIG*) to 480 observations.

In both cases, when reporting results we use contracts for mental health services as the default. There are a number of ways of summarising the estimates of the multinomial logit model but since the purpose here is to examine the extent to which the predictions of contract theory are confirmed or refuted by the data the most useful results are those that express the effect of  $X_i$  on the relative probability of a contract being one of two forms.

This comparison is made in Table 5 and Table 7. A corresponding summary of the effect of each of the explanatory variables on the probability of each different form of contract (that is the *marginal* effect of observable variables on the overall probability of a contract being of a given type) is in Table 6 and Table 8. As is standard practice these marginal effects (and their associated *t-ratios*) are evaluated at sample means.

We focus on the statistically significant effects identified. Where a contract is for acute services, the likelihood of it being sophisticated block relative to it being block is increased as is the likelihood of it being ‘other’ relative to it being block. Overall contracts for acute services are more likely to be sophisticated block and less likely to be block. This is, of course, relative to the default of contracts for mental health services.

Where a contract is for non acute services, the likelihood of it being sophisticated block relative to it being block is increased with no significant effect on the relative likelihood of block and ‘other’. Overall contracts for non acute services are more likely to be sophisticated block.

In contrast to the above, where a contract is for community services the likelihood of it being ‘other’ relative to it being block is decreased. At reduced level of significance there is also a reduction in the likelihood of it being ‘other’ relative to sophisticated block. Overall contracts for community services are more likely to be block.

Where a contract is for multiple services the likelihood of it being sophisticated block relative to it being block is increased as is the likelihood of it being ‘other’ relative to it being block. Overall contracts for multiple services are more likely to be sophisticated block and less likely to be block.

Where a contract has a GP purchaser the likelihood of it being sophisticated block relative to it being block is decreased. Overall contracts with GPs are more likely to be block and less likely to be sophisticated block.

Contracts where an NHS Trust is the provider have a decreased likelihood of being sophisticated block relative to being block. Overall these contracts are less likely to be sophisticated block and more likely to be block.

An increase in the number of providers in an area reduces the likelihood that a contract is block and increases the likelihood of it being sophisticated block.

An increase in the number of purchasers has few well defined effects. Overall it marginally increases the likelihood of block contracts.

Where a contract has a provider from outside of a health authority's area the likelihood of it being sophisticated block relative to it being block is increased as is the likelihood of it being 'other' relative to it being block. At a reduced level of significance there is an increased likelihood of it being 'other' relative to it being sophisticated block. Overall contracts with outside providers are less likely to be block and more likely to be sophisticated block.

Only three of our health authorities exert significant effects on the choice of contract form. Of these the strongest effects are for D34 (Cambridge) which favours block contracts and avoids sophisticated block.

The most notable feature of the results from data set 2 with regard to the type of service being contracted for is their consistency with the results reported above. In this data set there were no contracts for multiple services.

The novel elements in data set 2, *CLINSIG* and *INF*, also have some significant effects.

The presence of clinicians in contract negotiations significantly increases the likelihood of sophisticated block relative to block and overall increases the likelihood of sophisticated block and reduces the likelihood of block.

The information variable has more marginal effects. Greater information is significantly associated only with a lower likelihood of block contracts.

## **6. Discussion**

At the time contracts were initiated in the NHS there was considerable scepticism as to the degree of sophistication which purchasers and providers would bring to the contract negotiations. However, the view that contracts are chosen arbitrarily would appear to be resoundingly rejected by the data. The view that contracts are chosen at the whim of individual purchasers is also resoundingly rejected. We find only three purchaser dummies that are significant in explaining the form of contract adopted. The results summarised above exhibit many statistically significant effects that are consistent across two independent data sets. The nature of the services being contracted for, characteristics of the purchasers and the providers significantly influence the outcome in terms of the form of contract that is observed. This is, therefore, strong evidence that purchasers and providers are acting consistently and according to some principles in choosing their contracts.

Are the principles being adopted consistent with those suggested in the extensive theoretical literature on health contracting? To relate the empirical findings to our theoretical predictions it is necessary to refer back to cost and volume dependency in the different forms of contracts. A movement from block to 'other' (cost per case plus cost and volume) is an unambiguous increase in volume dependency as is a move towards sophisticated block from block, which is also indicative of an increase in cost dependency. A movement from 'other' to sophisticated block is indicative of increased cost dependency but cannot be safely interpreted as either an increase or a decrease in volume dependency<sup>8</sup>. Combining these observations, Table 9 directly compares the empirical findings with our theoretical predictions.

The empirical findings, therefore, accord well with our discussion of contract theory applied to health services. In the case of acute services, for example, the greater demand variability and case mix variation that characterises these services is predicted to lead to both greater cost and volume dependency and this is what we find in practice.

For non-acute services we noted that, since there is relatively little expression of patient choice, more cost dependency is indicated if providers do not reflect a purchaser's concerns for patient. Theory was ambiguous in predicting volume dependency for non-acute services because of two competing effects. First, these services are subject to more variation in demand than mental health services which are used as the basis for comparison. On purely risk sharing grounds we should, therefore, expect more volume dependency in contracts for non-acute services. Secondly, however, from the perspective of incentives, there is a greater certainty over the volume of services that providers would like to have delivered because this is limited by capacity. In the presence of benevolent providers, for example, this would lead to the adoption of contracts with less volume dependency. We find that contracts for non-acute services are, in fact more volume dependent. This, therefore is consistent with an incentive view conditional upon providers not being benevolent.

For community services the lack of volume dependency is hardly surprising given the difficulties in even defining activity levels for these diverse services. We argued that cost dependency was however, likely to be an important element of contracts for these services because of the perceived lack of patient choice which arises because of the predominance of local providers for such services. Our empirical findings do not reject this view be-

cause there is some evidence of increased cost dependency in the favouring of sophisticated block contracts over 'other' but the results are not significant at the usual 95% level.

Contracts for multiple services provide a way of discriminating between incentive and risk sharing motivations for contract form. If, as seems reasonable, a greater diversity of services gives a provider some insurance against fluctuations in demand for any one type of service, contracts for multiple services can be less cost and volume dependent. According, however, to an incentive view of contracts a greater range of services may lead to a greater variation in the mixture of patients that a provider will have to treat. If the provider is not to skimp on quality for the most difficult patients an element of cost dependency is important. We find significantly more cost dependency in contracts where there are multiple services and, therefore, more support for this incentive view than for the risk sharing view.

Contract theory did not provide us with any clear indication of the effect of Trust status. It has sometimes been suggested that the granting of independence to hospitals in the NHS would result in them being less concerned with patients' interests. If this view is true then the first hospitals to convert to Trust status might be expected to be those that were more independently organised and, perhaps, already less concerned with their patients. The data provide a way of testing this view and it is rejected. If Trusts were more self interested than other providers we would expect purchasers to impose stronger incentives in contracts with trusts than with DMUs but we find the opposite. In the early days of contracting in the NHS, Trusts were subject to less cost and volume dependency in their contracts, not more.

We have argued that an incentive based view of contracts suggests that external providers may need to be subject to stronger incentives in their contracts because of weaker reputation effects. The greater cost and volume dependency that we find in contracts with external providers therefore suggests further support for this incentive view. This is another instance where the data allow some degree of discrimination between theories. There is no obvious reason why external providers should require more insurance against fluctuation in either demand or costs than local providers, so it hard to account for our finding using a risk sharing argument.

Both because they have small budgets, and are therefore likely to want certainty over their expenditures, and because they are better able to assess the quality of service than



health authority purchasers, we expect GPs to write contracts with less cost and volume dependency. This is supported by the data.

From theoretical considerations alone, the effect of competition variables on cost and volume dependency in contracts is ambiguous. An important question is whether, for example, increased competition between providers generates positive incentives towards high quality so that contracts need to include less high powered incentives. The evidence available in our data suggests that it does not. We, in fact, find no significant effects of competition on cost and volume dependency in NHS contracts. This finding is consistent with the lack of an impact for competition elsewhere in the NHS as found, for example, by Propper and Wilson (1996). As regards the effect of increased competition in terms of number of purchasers, the only effect we find is towards less cost dependency in contracts. There is, as far as we are aware, no obvious explanation for this and it may be an issue worthy of further consideration.

One policy issue that our results shed light on concerns the involvement of clinicians in contract negotiations. One of the Department of Health's "seven imperatives for contracting" (see National Audit Office (1995)) is for "*involvement of Doctors in the contracting process*". If clinicians did not exert much impact on the outcome of the contract negotiations they were involved with, this might not be an important issue. However, the data suggest that clinicians do exert a significant influence and that influence can be interpreted as being consistent with them representing the interests of patients in a way that purchasers may well favour.

A second policy issue that this research has a potential input on is the use of cost dependency in contracts for health services. Contract theory has flourished as a vehicle for considering contracts for health services, particularly where there is a publicly funded purchaser. Within this literature a number of reasons why cost dependency might improve contracts have been suggested. However, it has not previously been possible to assess the relevance of that theory to practice because instances of purchasers actually choosing the form of contract that they enter into are very limited. In this important respect the British NHS provides an interesting test bed. The expectation at the time that the reforms of the NHS were proposed (see National Audit Office (1995)) was that contracts would move rapidly towards volume (and volume alone) as the conditioning variable for payment. In fact contracts in the NHS are predominantly of the sophisticated block form which, we

have argued, displays only limited volume dependency but allows some possibility of cost dependency. Are health purchasers in the NHS simply slow to react or are they responding in a way that is entirely consistent with the predictions of economic theory, perhaps choosing those contracts that really do best meet their needs? The evidence from this empirical study is consistent with the second view and, hence, provides support for contract theory. It, therefore, has policy implications for both the US and the UK health care systems where cost dependency in contracts is often viewed as undesirable. Evidence from this study for the UK and from McClellan (1997) in the US suggests that cost dependency is a feature of payment systems. If health authorities in the UK are correctly reflecting their concerns in choosing contracts, then theory suggests that there may be good reasons for permitting, or even encouraging, that cost dependency.

## References

- Allen, R. and Gertler, P. (1991), Regulation and the provision of quality to heterogeneous consumers: The case of prospective pricing of medical services, *Journal of Regulatory Economics* **3**: 361-375.
- Chalkley, M. and Malcomson, J. M. (1998a), Contracting for health services when patient demand does not reflect quality, *Journal of Health Economics* **17**(1): 1-19..
- Chalkley, M and Malcomson, J. M. (1998b), Contracting for health services with unmonitored quality, *Economic Journal* **108**(449): 1093-1110.
- Cohen, J. W. and Spector, W. D. (1996), The effect of Medicaid reimbursement on the quality of care in nursing homes, *Journal of Health Economics* **15**: 23-48.
- DesHarnais, S. I., Wroblewski, R. and Schumacher, D. (1990), How the Medicare prospective payment system affects psychiatric patients treated in short term general hospitals, *Inquiry* **27** : 382-388.
- Ellis, R. P. and McGuire, T. G. (1986), Provider behavior under prospective reimbursement: Cost sharing and supply, *Journal of Health Economics* **5**: 129-151.
- Ellis, R. P. and McGuire, T. G. (1990), Optimal payment systems for health services, *Journal of Health economics* **9**(4): 375-396.
- Ellis, R. P. and McGuire, T. G. (1996), Hospital response to prospective payment: Moral hazard, selection, and practice-style effects, *Journal of Health Economics* **15** 257-277
- Freiman, M. P., Ellis, R. P. and McGuire, T. G. (1989), Provider response to Medicare's PPS: Reductions in length of stay in psychiatric patients treated in scatter beds, *Inquiry* **26**: 192-201.
- Glazer, J. and McGuire, T. G. (1994), Payer competition and cost shifting in health care, *Journal of Economics and Management Strategy* **3**(1): 71-92.
- Hart, O. and Holmström, B. (1987), The theory of contracts, Chapter 3: 71-155 in *Advances in Economic Theory: Fifth World congress*, Edited by Bewley, T. F. Cambridge University Press, Cambridge, UK.

- Holmstrom, B. and Milgrom, P. (1991), Multitask principal-agent analyses: Incentive contracts, asset ownership and job design, *Journal of Law, Economics, and Organization* **7**: 24-52.
- National Audit Office (1995), Contracting for acute health care in England. *Report by the Comptroller and Auditor General*. London: HMSO.
- NHS Management Executive (1990), *NHS Trusts: A working guide*. London: HMSO.
- Norton, E.C. (forthcoming) Long Term Care, Chapter 21 in *Handbook of Health Economics*, North Holland : Amsterdam.
- Norton, E.C. and Newhouse, J.P. (1994) Policy options for public long-term care insurance, *Journal of the American Medical Association* **271(19)**: 1520-1524.
- Ma, C.-t. A. (1994), Health care payment systems: Cost and quality incentives, *Journal of Economics and Management Strategy* **3(1)**: 93-112.
- McClellan, M. (1997), Hospital reimbursement incentives: An empirical analysis, *Journal of Economics and Management Strategy* **6(1)**: 91-128.
- Pope, G. C. (1989), Hospital nonprice competition and Medicare reimbursement policy, *Journal of Health Economics* **8(2)**: 147-172.
- Propper, C. and Wilson, D. (1996), Price and competition in the NHS internal market in GP fundholder procedures, *Working paper, University of Bristol*.
- Robinson, R. and Le Grand, J. (eds.) (1993), *Evaluating the NHS Reforms*, King's Fund Institute.
- Rogerson, W. P. (1994), Choice of treatment intensities by a non-profit hospital under prospective pricing, *Journal of Economics and Management Strategy* **3(1)**: 7-51.
- Spence, A. M. (1975), Monopoly, quality and regulation, *Bell Journal of Economics*, **6(3)**: 417-429.
- Tirole, J. (1989), *The Theory of Industrial Organization*, Cambridge, MA, MIT Press.

## Tables and Figures

	Factors Increasing Volume Dependence	Factors Increasing Cost Dependence
Types of Health Services	<ul style="list-style-type: none"> <li>Uncertain Demand</li> </ul>	<ul style="list-style-type: none"> <li>Uncertain Case Mix.</li> <li>Quality that can only be 'experienced'</li> <li>Patients unable to choose where to be treated.</li> </ul>
Characteristics of Providers	<ul style="list-style-type: none"> <li>Objectives that are not aligned with those of purchaser.</li> <li>Risk aversion</li> <li>Absence of a reputation with (or long term commitment to) the purchaser</li> </ul>	<ul style="list-style-type: none"> <li>Objectives that are not aligned with those of purchaser.</li> <li>Risk aversion</li> <li>Absence of a reputation with (or long term commitment to) the purchaser</li> </ul>
Characteristics of Purchasers	<ul style="list-style-type: none"> <li>Ability to absorb risk</li> </ul>	<ul style="list-style-type: none"> <li>Ability to absorb risk</li> <li>Poor knowledge of quality of service, combined with a concern for quality</li> </ul>

**Table 1: factors affecting cost and volume dependency in health contracts.**

Variable	Description	Sample Mean (Std. Dev.) Data Set 1	Sample Mean (Std. Dev.) Data Set 2
AC	Equal to 1 if the contract includes acute services and zero otherwise.	0.29	0.33
HNAC	Equal to 1 if the contract includes non-acute hospital services and zero otherwise.	0.2	n/a
MH	Equal to 1 if the contract includes mental health services and zero otherwise	0.21	0.35
CS	Equal to 1 if the contract is for community health services and zero otherwise	0.2	0.32
MULTIPLE	Equal to 1 if the contract is for more than one of the above and zero otherwise	0.1	0
TRUST	Equal to 1 if the contract is with an NHS Trust and zero otherwise	0.07	n/a
EXT	Equal to 1 if the provider is external to the boundary of the health authority's region and zero otherwise	0.15	0.21
GP	Equal to 1 if the purchaser is a fundholding GP and zero otherwise	0.07	n/a
PURCOMP	A measure of purchaser competition equal to the number of GP fundholders per 100,000 of population.	0.51 (0.52)	n/a
PROVCMP	A measure of provider competition equal to the number of providers of similar services in a given geographical area.	2.1 (5.33)	n/a
D1,D2 etc.	Equal to 1 if a purchaser is a specific District Health Authority	Range: 0.005 to 0.07	n/a
CLINSIG	Equal to 1 if clinicians are included in contract negotiations and are reported to have a significant influence	n/a	0.35
INF	A measure of the amount of information available during contract negotiations ranging from 1 = only activity levels to 5 = specific cost data on sub-specialities	n/a	3.09 (1.75)

**Table 2: Observed variables and summary statistics (n/a = data not available)**

Service	Average Growth <sup>9</sup> percent	Variability about trend growth <sup>10</sup>
Acute	3.5	0.11
Non-acute	4.6	0.07
Mental	1.3	0.04

**Table 3: Growth and variability of broadly defined services in the NHS**

Variable	Expected effect on volume dependency	Expected effect on cost dependency
AC	+	+
HNAC	?	+
MH	-	?
CS	-	+
MULTIPLE	- (if risk dominates) ? (otherwise)	- (if risk dominates) + (otherwise)_
TRUST	?	?
EXT	+	+
GP	-	-
PURCOMP	?	?
PROVCMP	?	?
CLINSIG	?	+
INF	?	?

**Table 4: Expected effects of observable variables on cost and volume dependency in NHS contracts.**

	Sophisticated Block relative to Block	Other relative to Block	Other relative to Sophisticated Block
variable	coefficient (t-ratio)	coefficient (t-ratio)	coefficient (t-ratio)
Constant	0.660 (1.098)	-1.457 (-1.605)	-2.117 (-2.709)
AC	1.955 (2.589)	2.273 (2.462)	0.318 (0.453)
HNAC	1.935 (2.426)	0.917 (0.850)	-1.017 (-1.206)
CS	-0.635 (-1.288)	-2.775 (-2.224)	-2.140 (-1.775)
MULTIPLE	3.956 (2.784)	3.295 (2.127)	-0.661 (-0.774)
GP	-4.112 (-3.442)	-2.723 (-1.731)	1.389 (1.174)
TRUST	-2.293 (-2.240)	-1.924 (-1.424)	0.368 (0.293)
PURCOMP	-0.194 (-1.801)	-0.730 (-1.058)	-0.536 (-0.919)
PROVCOMP	0.351 (0.386)	0.127 (0.446)	-0.223 (-0.966)
EXTERNAL	3.303 (3.125)	4.466 (3.630)	1.162 (1.624)
D15	-0.416 (-0.396)	0.334 (0.224)	0.750 (0.592)
D19	-0.214 (-0.214)	1.458 (1.563)	1.672 (2.078)
D34	-2.340 (-3.033)	-0.807 (-0.089)	2.260 (3.358)

**Table 5: Coefficient estimates ( $\partial \ln \left( \frac{P_j}{P_k} \right) / \partial X$ ) for Data Set 1.**

	Block		Sophisticated Block		Other	
variable	coefficient	(t-ratio)	coefficient	(t-ratio)	coefficient	(t-ratio)
constant	-0.040	(-6.879)	0.153	(2.052)	-0.113	(-1.324)
AC	-0.150	(-18.050)	0.123	(2.550)	0.027	(0.529)
HNAC	-0.142	(-22.883)	0.188	(3.325)	-0.046	(-0.669)
CS	0.058	(6.901)	0.062	(0.819)	-0.120	(-1.087)
MULTIPLE	-0.297	(-21.458)	0.315	(4.327)	-0.017	(-0.193)
GP	0.306	(26.140)	-0.362	(-4.420)	0.056	(0.577)
TRUST	0.172	(19.937)	-0.181	(-2.670)	0.009	(0.122)
PURCOMP	0.017	(4.780)	0.013	(0.366)	-0.030	(-0.685)
PROVCOM	-0.026	(-15.894)	0.036	(3.084)	-0.011	(-0.531)
EXTERNAL	-0.256	(-18.365)	0.177	(2.512)	0.079	(0.975)
D15	0.028	(3.858)	-0.067	(-0.865)	0.039	(0.458)
D19	0.008	(1.408)	-0.099	(-1.523)	0.091	(1.183)
D34	0.167	(37.217)	-0.279	(-4.508)	0.112	(1.144)

**Table 6 : Marginal effects (  $\partial p_j / \partial X$  ) for Data Set 1.**



	Sophisticated Block relative to Block	Other relative to Block	Other relative to Sophisticated Block
variable	coefficient (t-ratio)	coefficient (t-ratio)	coefficient (t-ratio)
Constant	-0.059 (-1.168)	-1.664 (-2.715)	-1.078 (-2.217)
AC	2.167 (4.652)	2.547 (4.881)	0.380 (1.161)
CS	-0.125 (-0.470)	-0.415 (-1.026)	-0.289 (-0.760)
INFORMATION	0.148 (2.090)	0.165 (1.762)	0.018 (0.223)
CLINSIG	1.279 (4.227)	0.453 (1.139)	-0.927 (-2.732)
EXTERNAL	0.481 (1.049)	0.300 (0.573)	-0.180 (-0.493)

**Table 7 : Coefficient estimates ( $\partial \ln\left(\frac{P_j}{q}\right) / \partial x$ ) for Data Set 2**

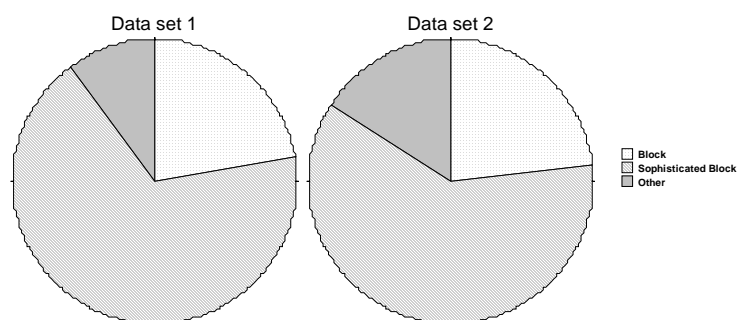
	Block		Sophisticated Block		Other	
variable	coefficient	t-ratio	coefficient	t-ratio	coefficient	t-ratio
constant	0.109	6.090	0.052	0.758	-0.161	-1.763
AC	-0.308	-13.636	0.199	3.310	0.109	1.645
CS	0.025	2.293	0.017	0.398	-0.043	-0.761
INFORMATION	-0.021	-7.767	0.015	1.415	0.006	0.496
CLINSIG	-0.154	-13.431	0.232	5.474	-0.078	-1.301
EXTERNAL	-0.061	-4.313	0.073	1.283	-0.017	-0.163

**Table 8 : Marginal effects ( $\partial p_j / \partial x$ ) for Data Set 2.**

Variable	Expected effect on volume dependency	Actual effect on volume dependency	Expected effect on cost dependency	Actual effect on cost dependency
AC	+	+	+	+
HNAC	?	+	- (if providers are 'benevolent') + (otherwise)	+
CS	-	-	+	?
MULTIPLE	- (if risk dominates) ? (otherwise)	+	- (if risk dominates) + (otherwise)	+
TRUST	+	-	+	-
EXT	+	+	+	+
GP	-	-	-	-
PURCOMP	?	?	?	-
PROVCMP	?	?	?	?
CLINSIG	?	+	+	+
INF	?	+	?	+

**Table 9 : Predicted versus actual effects on cost and volume dependency in NHS contracts**

**Figure 1: Forms of contracts observed**



## Footnotes

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<sup>1</sup> Health Authorities are bodies charged with purchasing health services on behalf of their resident population. They receive a cash limited budget determined according to a formula based on the population of their area weighted by age, sex and mortality.

<sup>2</sup> Large GP practices may apply for *fundholder* status, which provides them with a budget to purchase a pre-defined range of services on behalf of their patients. Health Authorities purchase the remaining services for the patients of fundholding GPs and *all* services for patients of non-fundholders.

<sup>3</sup> NHS Trusts are self-governing legal bodies that enjoy wide ranging powers to employ staff, set pay scales, enter into contracts, retain income and acquire or dispose of assets. However, these freedoms are subject to reservations and the Secretary of State for Health retains powers to intervene if a Trust's activities are against the public interest. Details of the principles under which NHS Trusts are formed can be found in NHS Management Executive (1990).

<sup>4</sup> From 1992 all contracts are required to have at least what was called an *indicative volume*. This provides an indication of the volume of services that was used in determining the lump sum payable. Indicative volumes do not, however, affect the actual payment and hence, we do not distinguish between block contracts with indicative volumes and those without.

<sup>5</sup> This same dichotomy between cost dependency and volume dependency of payments can be used to categorise payment systems in the US. Cost reimbursement of the kind used by Medicare prior to 1983, which has no equivalent in the NHS, for example, constitutes straightforward cost dependency whilst *prospective payment* supposedly entails only volume dependency except that, as noted above, McClellan (1997) finds some cost dependency even in prospective payment systems in practice.

<sup>6</sup> It is not enough to rely on a the provider's benevolence for it to return unused funds to the purchaser. Even a benevolent provider will want as large a budget as possible to spend on its *own* patients, whereas the purchaser has to balance the interests of the patients of many different providers.

<sup>7</sup> The requirement on trusts is that they balance revenue and costs "taking one year with another"

<sup>8</sup> The marginal effects (Table 6 and Table 8) are calculated at sample means. Since these effects (and their standard errors) are non-linear functions of the observable variables and will therefore vary depending on the particular values of  $X$  at which they are evaluated, we are cautious about relying on the significance of marginal effects in deriving empirical findings. Hence, only the parameter estimates (Table 5 and Table 7) are used in deriving Table 9.

<sup>9</sup> Growth rates are determined from data on total number of Finished Consultant Episodes in the NHS, 1960-1994 by running a regression  $\ln(N_t) = \beta_0 + \beta_1 t + \varepsilon$ ,  $N_t$  where is the number of FCEs and  $t$  is a time trend.

<sup>10</sup> Given by the variance of the residuals of the regression above, which is a unit free measure of variation around trend growth.